SEQUENCE LISTING

The Scripps Research Institute <110> Deiters, Alexander Cropp, T Ashton Chin, Jason W Anderson, J Christopher Schultz, Peter G <120> UNNATURAL REACTIVE AMINO ACID GENETIC CODE ADDITIONS 54-000250US/PC <130> <160> 104 PatentIn version 3.3 <170> <210> 1 1275 <211> <212> DNA <213> Escherichia coli <400> 1 60 atggcaagca gtaacttgat taaacaattg caagagcggg ggctggtagc ccaggtgacg 120 gacgaggaag cgttagcaga gcgactggcg caaggcccga tcgcgctcta ttgcggcttc gatcctaccg ctgacagctt gcatttgggg catcttgttc cattgttatg cctgaaacgc 180 240 ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc 300 gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg gtggacaaaa tccgtaagca ggttgccccg ttcctcgatt tcgactgtgg agaaaactct 360 420 gctatcgcgg cgaacaacta tgactggttc ggcaatatga atgtgctgac cttcctgcgc 480 gatattggca aacacttctc cgttaaccag atgatcaaca aagaagcggt taagcagcgt ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gttgcagggt 540 600 tatgacttcq cctqtctgaa caaacagtac ggtgtggtgc tgcaaattgg tggttctgac 660 cagtggggta acatcacttc tggtatcgac ctgacccgtc gtctgcatca gaatcaggtg 720 tttggcctga ccgttccgct gatcactaaa gcagatggca ccaaatttgg taaaactgaa ggcggcgcag tctggttgga tccgaagaaa accagcccgt acaaattcta ccagttctgg 780 atcaacactg cggatgccga cgtttaccgc ttcctgaagt tcttcacctt tatgagcatt 840 900 gaagagatca acgccctgga agaagaagat aaaaacagcg gtaaagcacc gcgcgcccag tatgtactgg cggagcaggt gactcgtctg gttcacggtg aagaaggttt acaggcggca 960 1020 aaacgtatta ccgaatgcct gttcagcggt tctttgagtg cgctgagtga agcggacttc 1080 gaacagctgg cgcaggacgg cgtaccgatg gttgagatgg aaaagggcgc agacctgatg caggcactgg tcgattctga actgcaacct tcccgtggtc aggcacgtaa aactatcgcc 1140 1200 tccaatgcca tcaccattaa cggtgaaaaa cagtccgatc ctgaatactt ctttaaagaa 1260 gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg

1275

<210> 2 <211> 424 <212> PRT

<213> Escherichia coli

<400> 2

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
20 25 30

Pro Ile Ala Leu Tyr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly .

70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Asp Phe Ala Cys Leu Asn Lys Gln Tyr Gly Val 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210 215 220 '

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 3

<211> 1275

<212> DNA

<213> Artificial

<220>

<223> artificial synthetase

<400> 3

atggcaagca gtaacttgat taaacaattg caagagcggg ggctggtagc ccaggtgacg

gacgaggaag cgttagcaga gcgactggcg caaggcccga tcgcactcgt gtgtggcttc Page 3 60

120

gatcctaccg	ctgacagctt	gcatttgggg	catcttgttc	cattgttatg	cctgaaacgc	180
ttccagcagg	cgggccacaa	gccggttgcg	ctggtaggcg	gcgcgacggg	tctgattggc	240
gacccgagct	tcaaagctgc	cgagcgtaag	ctgaacaccg	aagaaactgt	tcaggagtgg	300
gtggacaaaa	tccgtaagca	ggttgccccg	ttcctcgatt	tcgactgtgg	agaaaactct	360
gctatcgcgg	ccaataatta	tgactggttc	ggcaatatga	atgtgctgac	cttcctgcgc	420
gatattggca	aacacttctc	cgttaaccag	atgatcaaca	aagaagcggt	taagcagcgt	480
ctcaaccgtg	aagatcaggg	gatttcgttc	actgagtttt	cctacaacct	gctgcagggt	540
tatagtatgg	cctgtttgaa	caaacagtac	ggtgtggtgc	tgcaaattgg	tggttctgac	600
cagtggggta	acatcacttc	tggtatcgac	ctgacccgtc	gtctgcatca	gaatcaggtg	660
tttggcctga	ccgttccgct	gatcactaaa	gcagatggca	ccaaatttgg	taaaactgaa	720
ggcggcgcag	tctggttgga	tccgaagaaa	accagcccgt	acaaattcta	ccagttctgg	780
atcaacactg	cggatgccga	cgtttaccgc	ttcctgaagt	tcttcacctt	tatgagcatt	840
gaagagatca	acgccctgga	agaagaagat	aaaaacagcg	gtaaagcacc	gcgcgcccag	900
tatgtactgg	cggagcaggt	gactcgtctg	gttcacggtg	aagaaggttt	acaggcggca	960
aaacgtatta	ccgaatgcct	gttcagcggt	tctttgagtg	cgctgagtga	agcggacttc	1020
gaacagctgg.	cgcaggacgg	cgtaccgatg	gttgagatgg	aaaagggcgc	agacctgatg	1080
caggcactgg	tcgattctga	actgcaacct	tcccgtggtc	aggcacgtaa	aactatcgcc	1140
tccaatgcca	tcaccattaa	cggtgaaaaa	cagtccgatc	ctgaatactt	ctttaaagaa	1200
gaagatcgtc	tgtttggtcg	ttttacctta	ctgcgtcgcg	gtaaaaagaa	ttactgtctg	1260
atttgctgga	aataa					1275

<210> 4 <211> 1275 <212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 4
atggcaagca gtaacttgat taaacaattg caagagcggg ggctggtagc ccaggtgacg 60
gacgaggaag cgttagcaga gcgactggcg caaggcccga tcgcactcac ttgtggcttc 120
gatcctaccg ctgacagctt gcatttgggg catcttgttc cattgttatg cctgaaacgc 180
ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc 240
gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg 300
gtggacaaaa tccgtaagca ggttgccccg ttcctcgatt tcgactgtgg agaaaactct 360
gctatcgcgg ccaataatta tgactggttc agcaatatga atgtgctgac cttcctgcgc 420

gatattggca aacacttctc cgttaaccag atgatcaaca aagaagcggt taagcagcgt	480
ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggt	540
tatacgtatg cctgtctgaa caaacagtac ggtgtggtgc tgcaaattgg tggttctgac	600
cagtggggta acatcacttc tggtatcgac ctgacccgtc gtctgcatca gaatcaggtg	660
tttggcctga ccgttccgct gatcactaaa gcagatggca ccaaatttgg taaaactgaa	720
ggcggcgcag tctggttgga tccgaagaaa accagcccgt acaaattcta ccagttctgg	780
atcaacactg cggatgccga cgtttaccgc ttcctgaagt tcttcacctt tatgagcatt	840
gaagagatca acgccctgga agaagaagat aaaaacagcg gtaaagcacc gcgcgcccag	900
tatgtactgg cggagcaggt gactcgtctg gttcacggtg aagaaggttt acaggcggca	960
aaacgtatta ccgaatgcct gttcagcggt tctttgagtg cgctgagtga agcggacttc	1020
gaacagctgg cgcaggacgg cgtaccgatg gttgagatgg aaaagggcgc agacctgatg	1080
caggcactgg tcgattctga actgcaacct tcccgtggtc aggcacgtaa aactatcgcc	1140
tccaatgcca tcaccattaa cggtgaaaaa cagtccgatc ctgaatactt ctttaaagaa	1200
gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg	1260
atttgctgga aataa	1275
<210> 5 <211> 1275 <212> DNA <213> artificial <220> <223> artificial synthetase	
<400> 5 atggcaagca gtaacttgat taaacaattg caagagcggg ggctggtagc ccaggtgacg	60
gacgaggaag cgttagcaga gcgactggcg caaggcccga tcgcactcgt gtgtggcttc	120
gatectaceg etgacagett geatttgggg catettgtte cattgttatg eetgaaaege	180
ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc	240
gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg	300
gtggacaaaa tccgtaagca ggttgccccg ttcctcgatt tcgactgtgg agaaaactct	360
gctatcgcgg ccaataatta tgactggttc ggcaatatga atgtgctgac cttcctgcgc	420
gatattggca aacacttctc cgttaaccag atgatcaaca aagaagcggt taagcagcgt	480
ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggt	540
tatagtatgg cctgtttgaa caaacagtac ggtgtggtgc tgcaaattgg tggttctgac	600
catagtatgg cetgetegaa caaacagtae ggegege egeadaeegg eggeeeegae	600

ggcggcgcag tctggttgga tccgaagaaa accagcccgt acaaattcta ccagttctgg Page 5 660720

780

cagtggggta acatcacttc tggtatcgac ctgacccgtc gtctgcatca gaatcaggtg

tttggcctga ccgttccgct gatcactaaa gcagatggca ccaaatttgg taaaactgaa

tatgtactgg cggagcaggt gactcgtctg gttcacggtg aagaaggttt acaggcggca 960 aaacgtatta ccgaatgcct gttcagcggt tctttgagtg cgctgagtga agcggacttc 1020 gaacagctgg cgcaggacgg cgtaccgatg gttgagatgg aaaagggcgc agacctgatg 1080 caggcactgg tcgattctga actgcaacct tcccgtggtc aggcacgtaa aactatcgcc 1140 tccaatgcca tcaccattaa cggtgaaaaa cagtccgatc ctgaatactt ctttaaagaa 1200 gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg 1260	atcaacactg	cggatgccga	cgtttaccgc	ttcctgaagt	tcttcacctt	tatgagcatt	840
aaacgtatta ccgaatgcct gttcagcggt tctttgagtg cgctgagtga agcggacttc 1020 gaacagctgg cgcaggacgg cgtaccgatg gttgagatgg aaaagggcgc agacctgatg 1080 caggcactgg tcgattctga actgcaacct tcccgtggtc aggcacgtaa aactatcgcc 1140 tccaatgcca tcaccattaa cggtgaaaaa cagtccgatc ctgaatactt ctttaaagaa 1200 gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg 1260	gaagagatca	acgccctgga	agaagaagat	aaaaacagcg	gtaaagcacc	gcgcgcccag	900
gaacagctgg cgcaggacgg cgtaccgatg gttgagatgg aaaagggcgc agacctgatg 1080 caggcactgg tcgattctga actgcaacct tcccgtggtc aggcacgtaa aactatcgcc 1140 tccaatgcca tcaccattaa cggtgaaaaa cagtccgatc ctgaatactt ctttaaagaa 1200 gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg 1260	tatgtactgg	cggagcaggt	gactcgtctg	gttcacggtg	aagaaggttt	acaggcggca	960
caggcactgg tcgattctga actgcaacct tcccgtggtc aggcacgtaa aactatcgcc 1140 tccaatgcca tcaccattaa cggtgaaaaa cagtccgatc ctgaatactt ctttaaagaa 1200 gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg 1260	aaacgtatta	ccgaatgcct	gttcagcggt	tctttgagtg	cgctgagtga	agcggacttc	1020
tccaatgcca tcaccattaa cggtgaaaaa cagtccgatc ctgaatactt ctttaaagaa 1200 gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg 1260	gaacagctgg	cgcaggacgg	cgtaccgatg	gttgagatgg	aaaagggcgc	agacctgatg	1080
gaagatcgtc tgtttggtcg ttttacctta ctgcgtcgcg gtaaaaagaa ttactgtctg 1260	caggcactgg	tcgattctga	actgcaacct	tcccgtggtc	aggcacgtaa	aactatcgcc	1140
1085	tccaatgcca	tcaccattaa	cggtgaaaaa	cagtccgatc	ctgaatactt	ctttaaagaa	1200
atttgctgga aataa 1275	gaagatcgtc	tgtttggtcg	ttttacctta	ctgcgtcgcg	gtaaaaagaa	ttactgtctg	1260
	atttgctgga	aataa					1275

<210> 6 <211> 1275

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 60 atggcaagca gtaacttgat taaacaattg caagagcggg ggctggtagc ccaggtgacg gacgaggaag cgttagcaga gcgactggcg caaggcccga tcgcactcgt gtgtggcttc 120 gatcctaccg ctgacagctt gcatttgggg catcttgttc cattgttatg cctgaaacgc 180 240 ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc 300 gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg 360 gtggacaaaa tccgtaagca ggttgccccg ttcctcgatt tcgactgtgg agaaaactct gctatcgcgg ccaataatta tgactggttc ggcaatatga atgtgctgac cttcctgcgc 420 gatattggca aacacttctc cgttaaccag atgatcaaca aagaagcggt taagcagcgt 480 540 ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggt 600 tatagtatgg cctgtttgaa caaacagtac ggtgtggtgc tgcaaattgg tggttctgac cagtggggta acatcacttc tggtatcgac ctgacccgtc gtctgcatca gaatcaggtg 660 720 tttggcctga ccgttccgct gatcactaaa gcagatggca ccaaatttgg taaaactgaa 780 ggcggcgcag tctggttgga tccgaagaaa accagcccgt acaaattcta ccagttctgg atcaacactg cggatgccga cgtttaccgc ttcctgaagt tcttcacctt tatgagcatt 840 900 gaagagatca acgccctgga agaagaagat aaaaacagcg gtaaagcacc gcgcgcccag 960 tatgtactgg cggagcaggt gactcgtctg gttcacggtg aagaaggttt acaggcggca aaacgtatta ccgaatgcct gttcagcggt tctttgagtg cgctgagtga agcggacttc 1020 1080 gaacagctgg cgcaggacgg cgtaccgatg gttgagatgg aaaagggcgc agacctgatg

caggcactgg tcgatto	ctga actgcaacct	tcccgtggtc	aggcacgtaa	aactatcgcc	1140
tccaatgcca tcaccat	taa cggtgaaaaa	cagtccgatc	ctgaatactt	ctttaaagaa	1200
gaagatcgtc tgtttgg	gtcg ttttacctta	ctgcgtcgcg	gtaaaaagaa	ttactgtctg	1260
atttgctgga aataa					1275
<210> 7 <211> 1275					
<212> DNA <213> artificial					
<220> <223> artificial	synthetase				
<400> 7					
atggcaagca gtaactt	tgat taaacaattg	caagagcggg	ggctggtagc	ccaggtgacg	60
gacgaggaag cgttag	caga gcgactggcg	caaggcccga	tcgcactcac	gtgtggcttc	120
gatcctaccg ctgacag	gett geatttgggg	catcttgttc	cattgttatg	cctgaaacgc	180
ttccagcagg cgggcca	acaa gccggttgcg	ctggtaggcg	gcgcgacggg	tctgattggc	240
gacccgagct tcaaag	ctgc cgagcgtaag	ctgaacaccg	aagaaactgt	tcaggagtgg	300
gtggacaaaa tccgtaa	agca ggttgccccg	ttcctcgatt	tcgactgtgg	agaaaactct	360
gctatcgcgg ccaata	atta tgactggttc	ggcaatatga	atgtgctgac	cttcctgcgc	420
gatattggca aacact	tctc cgttaaccag	atgatcaaca	aagaagcggt	taagcagcgt	480
ctcaaccgtg aagatca	aggg gatttcgttc	actgagtttt	cctacagcct	gctgcagggt	540
tatacgatgg cctgtc	tgaa caaacagtac	ggtgtggtgc	tgcaaattgg	tggttctgac	600
cagtggggta acatcad	cttc tggtatcgac	ctgacccgtc	gtctgcatca	gaatcaggtg	660
tttggcctga ccgttc	cgct gatcactaaa	gcagatggca	ccaaatttgg	taaaactgaa	720
ggcggcgcag tctggt	tgga tccgaagaaa	accagcccgt	acaaattcta	ccagttctgg	780
atcaacactg cggatge	ccga cgtttaccgc	ttcctgaagt	tcttcacctt	tatgagcatt	840
gaagagatca acgccc	tgga agaagaagat	aaaaacagcg	gtaaagcacc	gcgcgcccag	900
tatgtactgg cggagca	aggt gactcgtctg	gttcacggtg	aagaaggttt	acaggcggca	960
aaacgtatta ccgaat	gcct gttcagcggt	tctttgagtg	cgctgagtga	agcggacttc	1020
gaacagctgg cgcagg	acgg cgtaccgatg	gttgagatgg	aaaagggcgc	agacctgatg	1080
caggcactgg tcgatte	ctga actgcaacct	tcccgtggtc	aggcacgtaa	aactatcgcc	1140
tccaatgcca tcacca	ttaa cggtgaaaaa	cagtccgatc	ctgaatactt	ctttaaagaa	1200
gaagatcgtc tgtttg	gtcg ttttacctta	ctgcgtcgcg	gtaaaaagaa	ttactgtctg	1260
atttgctgga aataa					1275

<212> DNA <213> artificial
<220> <223> artificial synthetase
<400> 8 cgggggctgg tagcccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60
ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcagcaat 360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc 420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
ttttcctaca acctgctgca gggttatacg tatgcctgtc tgaacaaaca gtacggtgtg 540
<210> 9 <211> 540 <212> DNA <213> artificial <220> <223> artificial synthetase
<400> 9
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60 ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60 ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60 ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcagcaat 360
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60 ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcagcaat 360 atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc 420
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60 ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcagcaat 360 atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc 420 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60 ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcagcaat 360 atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc 420
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc 60 ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcagcaat 360 atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc 420 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc ccgatcgcac tcacttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttge cccgttcctc gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcagcaat atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc 420 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag ttttcctaca acctgctgca gggttatacg tatgcctgtc tgaacaaaca gtacggtgt <210> 10 <211> 540 <212> DNA <213> artificial <220>

ccgatcgcac tcacttgtgg	cttcgatcct	accgctgaca	gcttgcattt	ggggcatctt	120
gttccattgt tatgcctgaa	acgcttccag	caggcgggcc	acaagccggt	tgcgctggta	180
ggcggcgcga cgggtctgat	tggcgacccg	agcttcaaag	ctgccgagcg	taagctgaac	240
accgaagaaa ctgttcagga	gtgggtggac	aaaatccgta	agcaggttgc	cccgttcctc	300
gatttcgact gtggagaaaa	ctctgctatc	gcggccaata	attatgactg	gttcagcaat	360
atgaatgtgc tgaccttcct	gcgcgatatt	ggcaaacact	tctccgttaa	ccagatgatc	420
aacaaagaag cggttaagca	gcgtctcaac	cgtgaagatc	aggggatttc	gttcactgag	480
ttttcctaca acctgctgca	gggttatacg	tatgcctgtc	tgaacaaaca	gtacggtgtg	540
<210> 11 <211> 540 <212> DNA <213> artificial					
<223> artificial syn	thetase				
<400> 11 cgggggctgg tagcccaggt	gacggacgag	gaagcgttag	cagagcgact	ggcgcaaggc	60
ccgatcgcac tcacttgtgg	cttcgatcct	accgctgaca	gcttgcattt	ggggcatctt	120
gttccattgt tatgcctgaa	acgcttccag	caggcgggcc	acaagccggt	tgcgctggta	180
ggcggcgcga cgggtctgat	tggcgacccg	agcttcaaag	ctgccgagcg	taagctgaac	240
accgaagaaa ctgttcagga	gtgggtggac	aaaatccgta	agcaggttgc	cccgttcctc	300
gatttcgact gtggagaaaa	ctctgctatc	gcggccaata	attatgactg	gttcggcaat	360
atgaatgtgc tgaccttcct	gcgcgatatt	ggcaaacact	tctccgttaa	ccagatgatc	420
aacaaagaag cggttaagca	gcgtctcaac	cgtgaagatc	aggggatttc	gttcactgag	480
ttttcctaca acctgctgca	gggttattcg	tatgcctgtg	cgaacaaaca	gtacggtgtg	540
<210> 12 <211> 540 <212> DNA <213> artificial					
<220> <223> artificial syr	thetase				
<400> 12 cgggggctgg tagcccaggt	gacggacgag	gaagcgttag	cagagcgact	ggcgcaaggc	60
ccgatcgcac tcacttgtgg	cttcgatcct	accgctgaca	gcttgcattt	ggggcatctt	120
gttccattgt tatgcctgaa	acgcttccag	caggcgggcc	acaagccggt	tgcgctggta	180
ggcggcgcga cgggtctgat	tggcgacccg	agcttcaaag	ctgccgagcg	taagctgaac	240
accgaagaaa ctgttcagga	gtgggtggac	aaaatccgta	agcaggttgc	cccgttcctc	300
gatttcgact gtggagaaaa	ctctgctatc	gcggccaata Page S		gttcagcaat	360

atgaatgtgc	tgaccttcct	gcgcgatatt	ggcaaacact	tctccgttaa	ccagatgatc	420
aacaaagaag	cggttaagca	gcgtctcaac	cgtgaagatc	aggggatttc	gttcactgag	480
ttttcctaca	acctgctgca	gggttatacg	tatgcctgtc	tgaacaaaca	gtacggtgtg	540
<210> 13 <211> 540 <212> DNA <213> arti	ificial					
<220> <223> art:	ificial synt	chetase				
<400> 13 cgggggctgg	taccccaggt	gacggacgag	gaagcgttag	cagagcgact	ggcgcaaggc	60
ccgatcgcac	tcctttgtgg	cttcgatcct	accgctgaca	gcttgcattt	ggggcatctt	120
gttccattgt	tatgcctgaa	acgcttccag	caggcgggcc	acaagccggt	tgcgctggta	180
ggcggcgcga	cgggtctgat	tggcgacccg	agcttcaaag	ctgccgagcg	taagctgaac	240
accgaagaaa	ctgttcagga	gtgggtggac	aaaatccgta	agcaggttgc	cccgttcctc	300
gatttcgact	gtggagaaaa	ctctgctatc	gcggccaata	attatgactg	gttcggcaat	360
atgaatgtgc	tgaccttcct	gcgcgatatt	ggcaaacact	tctccgttaa	ccagatgatc	420
aacaaagaag	cggttaagca	gcgtctcaac	cgtgaagatc	aggggatttc	gttcactgag	480
ttttcctaca	acctgctgca	gggttattct	attgcctgtt	cgaacaaaca	gtacggtgtg	540
<210> 14 <211> 540 <212> DNA <213> art	ificial					
<220> <223> art:	ificial syn	thetase				
<400> 14 cgggggctgg	tagcccaggt	gacggacgag	gaagcgttag	cagagcgact	ggcgcaaggc	60
ccgatcgcac	tcgtgtgtgg	cttcgatcct	accgctgaca	gcttgcattt	ggggcatctt	120
gttccattgt	tatgcctgaa	acgcttccag	caggcgggcc	acaagccggt	tgcgctggta	180
ggcggcgcga	cgggtctgat	tggcgacccg	agcttcaaag	ctgccgagcg	taagctgaac	240
accgaagaaa	ctgttcagga	gtgggtggac	aaaatccgta	agcaggttgc	cccgttcctc	300
gatttcgact	gtggagaaaa	ctctgctatc	gcggccaata	attatgactg	gttcggcaat	360
atgaatgtgc	tgaccttcct	gcgcgatatt	ggcaaacact	tctccgttaa	ccagatgatc	420
aacaaagaag	cggttaagca	gcgtctcaac	cgtgaagatc	aggggatttc	gttcactgag	480
ttttcctaca	acctgctgca	gggttatagt	attgcctgtt	tgaacaaaca	gtacggtgtg	540

<212> DNA <213> artificial	
<220> <223> artificial synthetase	
<400> 15 cgggggctgg taccccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc	60
ccgatcgcac tcgtgtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt	120
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta	180
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac	240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc	300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat	360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc	420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag	480
ttttcctaca acctgctgca gggttatagt attgcctgtt tgaacaaaca gtacggtgtg	540
<210> 16 <211> 540 <212> DNA <213> artificial <220> <223> artificial synthetase	
<400> 16 cgggggctgg tagcccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc	
coordanced careerage datagratery and are careerage career agreements	60
	60 120
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt	120
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta	120 180
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac	120 180 240
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc	120 180 240 300
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc gatttcgact gtggagaaaa ctctgctatc gcggccaatt gttatgactg gttcggcaat	120 180 240 300 360
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc gatttcgact gtggagaaaa ctctgctatc gcggccaatt gttatgactg gttcggcaat atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc	120 180 240 300 360 420
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc gattcgact gtggagaaaa ctctgctatc gcggccaatt gttatgactg gttcggcaat atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag	120 180 240 300 360 420 480
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc gatttcgact gtggagaaaa ctctgctatc gcggccaatt gttatgactg gttcggcaat atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc	120 180 240 300 360 420
ccgatcgcac tctggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc gattcgact gtggagaaaa ctctgctatc gcggccaatt gttatgactg gttcggcaat atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag	120 180 240 300 360 420 480
ccgatcgcac tetggtgtgg ettegatect accgetgaca gettgcattt ggggcatett gttccattgt tatgcetgaa acgettecag caggegggee acaageeggt tgegetggta ggeggegega egggtetgat tggegaceeg agetteaagg etgeegageg taagetgaac accgaagaaa etgtteagga gtgggtggac aaaateegta ageaggttge eeegtteete gatttegaet gtggagaaaa etetgetate geggeeaatt gttatgaetg gtteggeaat atgaatgtge tgacetteet gegegatatt ggeaaacaet teteegttaa ecagatgate aacaaagaag eggttaagea gegteteaae egtgaagate aggggattte gtteactgag ttteetaca acetgetgea gggttatatg egtgeetgtg agaacaaca gtaeggtgtg	120 180 240 300 360 420 480

ccgatcgcac tcatttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt	120
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta	180
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac	240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc	300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat	360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc	420
aacaaagaag cggttaagca gcgtctcaac cgtgaaggtc aggggatttc gttcactgag	480
ttttcctaca acctgctgca gggttatggt atggcctgtg ctaacaaaca gtacggtgtg	540
gtgctgcaaa ttggtggttc tgaccaatgg ggtaacatca cttctggtat cgacctgacc	600
cgtcgtctgc atcagaatca ggtg	624
<pre><210> 18 <211> 609 <212> DNA <213> artificial <220> <223> artificial synthetase</pre>	
<400> 18 caggtgacgg acgaggaagc gttagcagag cgactggcgc aaggcccgat cgcactcggt	60
tgtggcttcg atcctaccgc tgacagcttg catttggggc atcttgttcc attgttatgc	120
ctgaaacgct tccagcaggc gggccacaag ccggttgcgc tggtaggcgg cgcgacgggt	180
ctgattggcg acccgagctt caaagctgcc gagcgtaagc tgaacaccga agaaactgtt	240
caggagtggg tggacaaaat ccgtaagcag gttgccccgt tcctcgattt cgactgtgga	300
gaaaactctg ctatcgcggc caataattat gactggttcg gcaatatgaa tgtgctgacc	360
ttcctgcgcg atattggcaa acacttctcc gttaaccaga tgatcaacaa agaagcggtt	420
aagcagcgtc tcaaccgtga agatcagggg atttcgttca ctgagttttc ctacaacctg	480
ctgcagggtt atggttttgc ctgtttgaac aaacagtacg gtgtggtgct gcaaattggt	540
ggttctgacc agtggggtaa catcacttct ggtatcgacc tgacccgtcg tctgcatcag	600
aatcaggtg	609
<210> 19 <211> 591 <212> DNA <213> artificial <220> <223> artificial synthetase	
<400> 19 gcgttagcag agcgactggc gcaaggcccg atcgcactcg ggtgtggctt cgatcctacc	60

gctgacagct tgcatttggg gcatcttgtt ccattgttat gcctgaaacg cttccagcag	120
gcgggccaca agccggttgc gctggtaggc ggcgcgacgg gtctgattgg cgacccgagc	180
ttcaaagctg ccgagcgtaa gctgaacacc gaagaaactg ttcaggagtg ggtggacaaa	240
atccgtaagc aggttgcccc gttcctcgat ttcgactgtg gagaaaactc tgctatcgcg	300
gccaataatt atgactggtt cggcaatatg aatgtgctga ccttcctgcg cgatattggc	360
aaacacttct ccgttaacca gatgatcaac aaagaagcgg ttaagcagcg tctcaaccgt	420
gaagatcagg ggatttcgtt cactgagttt tcctacaacc tgctgcaggg ttatggttat	480
gcctgtatga acaaacagta cggtgtggtg ctgcaaattg gtggttctga ccagtggggt	540
aacatcactt ctggtatcga cctgacccgt cgtctgcatc agaatcaggt g	591
<pre><210> 20 <211> 621 <212> DNA <213> artificial </pre> <pre><220> <223> artificial synthetase <pre><221> misc_feature <222> (26)(26) <223> n is a, c, g, or t <pre><220> <221> misc_feature <222> (612)(612) <223> n is a, c, g, or t</pre> <pre><220> <221> misc_feature <222> (612)(612) <223> n is a, c, g, or t</pre> <pre><220> <221> misc_feature <222> (618)(618) <223> n is a, c, g, or t</pre></pre></pre>	
<400> 20 gggctggtag cccaggtgac ggacgnagaa gcgttagcag agcgactggc gcaaggcccg	60
atcgcactcc tttgtggctt cgatcctacc gctgacagct tgcatttggg gcatcttgtt	120
ccattgttat gcctgaaacg cttccagcag gcgggccaca agccggttgc gctggtaggc	180
ggcgcgacgg gtctgattgg cgacccgagc ttcaaagctg ccgagcgtaa gctgaacacc	240
gaagaaactg ttcaggagtg ggtggacaaa atccgtaagc aggttgcccc gttcctcgat	300
ttcgactgtg gagaaaactc tgctatcgcg gccaataatt atgactggtt cggcaatatg	360
aatgtgctga ccttcctgcg cgatattggc aaacacttct ccgttaacca gatgatcaac	420
aaagaagcgg ttaagcagcg tctcaaccgt gaagatcagg ggatttcgtt cactgagttt	480
tcctacaacc tgctgcaggg ttattctatg gcctgtgcga acaaacagta cggtgtggtg	540
ctgcaaattg gtggttctga ccagtggggt aacatcactt ctggtatcga cctgacccgt	600
cgtctgcatc anaatcangt g	621

```
<210>
       21
<211>
      588
<212>
      DNA
<213>
      artificial
<220>
<223> artificial synthetase
<400> 21
                                                                       60
ttagcagagc gactggcgca aggcccgatc gcactcgttt gtggcttcga tcctaccgct
gacagettge atttggggea tettgtteea ttgttatgee tgaaaegett ecageaggeg
                                                                      120
                                                                      180
ggccacaagc cggttgcgct ggtaggcggc gcgacgggtc tgattggcga cccgagcttc
                                                                       240
aaagctgccg agcgtaagct gaacaccgaa gaaactgttc aggagtgggt ggacaaaatc
                                                                      300
cgtaagcagg ttgccccgtt cctcgatttc gactgtggag aaaactctgc tatcgcggcc
                                                                      360
aataattatg actggttcgg caatatgaat gtgctgacct tcctgcgcga tattggcaaa
cacttctccg ttaaccagat gatcaacaaa gaagcggtta agcagcgtct caaccgtgaa
                                                                       420
                                                                       480
gatcagggga tttcgttcac tgagttttcc tacaacctgc tgcagggtta ttctgcggcc
tgtgcgaaca aacagtacgg tgtggtgctg caaattggtg gttctgacca gtggggtaac
                                                                       540
                                                                       588
atcacttctg gtatcgacct gacccgtcgt ctgcatcaga atcaggtg
<210>
       22
<211>
       600
<212>
       DNA
<213> artificial
<220>
<223> artificial synthetase
<220>
<221> misc_feature 
<222> (403)..(403)
<223> n is a, c, g, or t
<220>
<221> misc_feature
<222> (513)..(513)
<223> n is a, c, g, or t
<220>
<221> misc_feature
<222> (515)..(515)
<223> n is a, c, g, or t
<220>
<221> misc_feature
<222> (518)..(518)
<223> n is a, c, g, or t
<220>
<221> misc_feature
<222> (531)..(531)
<223> n is a, c, g, or t
```

```
<400> 22
gacgaggaag cgttagcaga gcgactggcg caaggcccga tcgcactcct gtgtggcttc
                                                                      60
                                                                     120
gatectaceg etgacagett geatttgggg catettgtte cattgttatg cetgaaacge
ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc
                                                                     180
qacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg
                                                                     240
                                                                     300
gtggacaaaa tccgtaagca ggttgccccg ttcctcgatt tcgactgtgg agaaaactct
gctatcgcgg ccaataatta tgactggttc ggcaatatga atgtgctgac cttcctgcgc
                                                                     360
                                                                      420
gatattggca aacacttctc cgttaaccag atgatcaaca aanaagcggt taagcagcgt
                                                                      480
ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggt
tattcqqctq cctqtqcqaa caaacagtac ggngnggngc tgcaaattgg nggttctgac
                                                                      540
                                                                      600
caggggggta acatcacttc tggtatcgac ctgacccgtc gtctgcatca aaatcaggtg
<210>
       23
<211>
      591
<212>
      DNA
<213> artificial
<220>
<223> artificial synthetase
<220>
<221>
      misc_feature
<222>
      (588)..(588)
<223> n is a, c, g, or t
<400> 23
gcgttagcag agcgactggc gcaaggcccg atcgcactcg tttgtggctt cgatcctacc
                                                                       60
gctgacagct tgcatttggg gcatcttgtt ccattgttgt gcctgaaacg cttccagcag
                                                                      120
                                                                      180
gcgggccaca agccggttgc gctggtaggc ggcggacgg gtctgattgg cgacccgagc
ttcaaagctg ccgagcgtaa gctgaacacc gaagaaactg ttcaggagtg ggtggacaaa
                                                                      240
                                                                      300
atccqtaaqc aqqttqcccc gttcctcgat ttcgactgtg gagaaaactc tgctatcgcg
gccaataatt atgactggtt cggcaatatg aatgtgctga ccttcctgcg cgatattggc
                                                                      360
                                                                      420
aaacacttct ccgttaacca gatgatcaac aaagaagcgg ttaagcagcg tctcaaccgt
                                                                      480
gaagatcagg ggatttcgtt cactgagttt tcctacaacc tgctgcaggg ttatagtgcg
                                                                      540
gcctgtgtta acaaacagta cggtgtggtg ctgcaaattg gtggttctga ccagtggggt
                                                                      591
aacatcactt ctggtatcga cctgacccgt cgtctgcatc agaatcangt g
<210>
       24
<211>
       600
<212> DNA
<213> artificial
```

<220>

<223> artificial synthetase

•	
<400> 24 gacgaggaag cgttagcaga gcgactggcg caaggcccga tcgcactcat ttgt	tggcttc 60
gatcctaccg ctgacagctt gcatttgggg catcttgttc cattgttatg cctg	gaaacgc 120
ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctg	gattggc 180
gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tca	ggagtgg 240
gtggacaaaa tccgtaagca ggttgccccg ttcctcgatt tcgactgtgg agaa	aaactct 300
gctatcgcgg ccaatgatta tgactggttc ggcaatatga atgtgctgac ctto	cctgcgc 360
gatattggca aacacttctc cgttaaccag atgatcaaca aagaagcggt taag	gcagcgt 420
ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctg	gcagggt 480
tataattttg cctgtgtgaa caaacagtac ggtgtggtgc tgcaaattgg tgg	ttctgac 540
cagtggggta acatcacttc tggtatcgac ctgacccgtc gtctgcatca gaat	tcaggtg 600
<210> 25 <211> 579 <212> DNA <213> artificial <220> <223> artificial synthetase	
<pre><400> 25 cgactggcgc aaggcccgat cgcactcacg tgtggcttcg atcctaccgc tgac</pre>	cagcttg 60
catttggggc atcttgttcc attgttatgc ctgaaacgct tccagcaggc ggg	ccacaag 120
ccggttgcgc tggtaggcgg cgcgacgggt ctgattggcg acccgagctt caa	agctgcc 180
gagcgtaagc tgaacaccga agaaactgtt caggagtggg tggacaaaat ccg	taagcag 240
gttgccccgt tcctcgattt cgactgtgga gaaaactctg ctatcgcggc caa	taattat 300
gactggttcg gcaatatgaa tgtgctgacc ttcctgcgcg atattggcaa acad	cttctcc 360
gttaaccaga tgatcaacaa agaagcggtt aagcagcgtc tcaaccgtga aga	tcagggg 420
atttcgttca ctgagttttc ctacaatctg ctgcagggtt attcggctgc ctg	tcttaac 480
aaacagtacg gtgtggtgct gcaaattggt ggttctgacc agtggggtaa cat	cacttct 540
ggtatcgacc tgacccgtcg tctgcatcag aatcaggtg	579

<210> 26
<211> 624
<212> DNA
<213> artificial

<220>
<223> artificial synthetase

<220> <221> misc_feature

```
<222> (13)..(13)
<223> n is a, c, g, or t
<220>
<221> misc_feature
<222>
      (599)..(599)
<223> n is a, c, g, or t
<400> 26
cgggggctgg tancccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc
                                                                      60
                                                                     120
ccgatcgcac tcgggtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt
                                                                     180
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta
                                                                     240
qqcqqcqca cqgqtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc
                                                                     300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat
                                                                     360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc
                                                                     420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag
                                                                     480
                                                                     540
ttttcctaca acctgctgca gggttattct atggcctgtt tgaacaaaca gtacggtgtg
gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctganc
                                                                      600
                                                                     624
cgtcgtctgc atcagaatca ggtg
<210>
       27
<211>
       625
<212>
      DNA
<213> artificial
<220>
<223> artificial synthetase
<220>
<221> misc_feature
<222>
      (600)..(600)
<223> n is a, c, g, or t
<400> 27
                                                                       60
cgggggctgg tagcccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc
                                                                      120
ccgatcgcac tcacgtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt
                                                                      180
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac
                                                                      240
                                                                      300
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc
                                                                      360
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc
                                                                      420
                                                                      480
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag
                                                                      540
ttttcctaca atctgctgca gggttattcg gctgcctgtc ttaacaaaca gtacggtgtg
```

gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgaacctgan	600
ccgtcgtctg catcaaaatc aagtg	625
<210> 28 <211> 624 <212> DNA <213> artificial	
<220> <223> artificial synthetase	
<400> 28 cgggggctgg taccccaagt gacggacgag gaaacgttag cagagcgact ggcgcaaggc	60
ccgatcgcac tctcttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt	120
gttccattgt tatgcctgaa acgcttccag caggcaggcc acaagccggt tgcgctggta	180
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac	240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc	300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat	360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc	420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag	480
ttttcctaca acctgctgca gggttatacg atggcctgtg tgaacaaaca gtacggtgtg	540
gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctgacc	600
cgtcgtctgc atcagaatca ggtg	624
<210> 29 <211> 624 <212> DNA <213> artificial	
<220> <223> artificial synthetase	
<400> 29 cgggggctgg tagcccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc	60
ccgatcgcac tcgcgtgcgg cttcgatcct accgctgaca gcttgcattt ggggcatctt	120
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta	180
ggcggcgcga cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac	240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc	300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat	360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc	420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag	480
ttttcctaca acctgctgca gggttattct tatgcctgtc ttaacaaaca gtacggtgtg	540
gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctgacc Page 18	600

د

. .

cgtcgtctgc atcagaatca ggtg	624
<210> 30 <211> 624 <212> DNA <213> artificial	0
<220> <223> artificial synthetase	
<400> 30 cgggggctgg tagcccaggt gacggacgag gaagcgttag cagagcgact ggcgcaag	gc 60
ccgatcgcac tcgcgtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatc	tt 120
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctgg	ta 180
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctga	ac 240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcc	tc 300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggca	at 360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatga	tc 420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactg	ag 480
ttttcctaca acctgctgca gggttatacg atggcctgtt gtaacaaaca gtacggtg	tg 540
gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctga	cc 600
cgtcgtctgc atcagaatca ggtg	624
<210> 31 <211> 624 <212> DNA <213> artificial	
<220> <223> artificial synthetase	
<400> 31 cgggggctgg taccccaagt gacggacgag gaagcgttag cagagcgact ggcgcaag	ıgc 60
ccgatcgcac tcacgtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatc	tt 120
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctgg	rta 180
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctga	ac 240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcc	tc 300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggca	at 360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatga	atc 420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcgctg	gag 480
ttttcctaca acctgctgca gggttatacg tttgcctgta tgaacaaaca gtacggtg	jtg 540
gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctga	acc 600

cgtcgtctgc atcagaatca ggtg	624
<210> 32 <211> 606 <212> DNA <213> artificial	
<220> <223> artificial synthetase	
<400> 32 gtgacggacg aggaagcgtt agcagagcga ctggcgcaag gcccgatcgc actcacgtgt	60
ggcttcgatc ctaccgctga cagcttgcat ttggggcatc ttgttccatt gttatgcctg	120
aaacgcttcc agcaggcggg ccacaagccg gttgcgctgg taggcggcgc gacgggtctg	180
attggcgacc cgagcttcaa agctgccgag cgtaagctga acaccgaaga aactgttcag	240
gagtgggtgg acaaaatccg taagcaggtt gccccgttcc tcgatttcga ctgtggagaa	300
aactctgcta tcgcggccaa taattatgac tggttcggca atatgaatgt gctgaccttc	360
ctgcgcgata ttggcaaaca cttctccgtt aaccagatga tcaacaaaga agcggttaag	420
cagcgtctca accgtgaaga tcaggggatt tcgttcactg agttttccta caatctgctg	480
cagggttatt cggctgcctg tcttaacaaa cagtacggtg tggtgctgca aattggtggt	540
tctgaccagt ggggtaacat cacttctggt atcgacctga cccgtcgtct gcatcagaat	600
caggtg	606
<210> 33 <211> 624 <212> DNA <213> artificial	
<220> <223> artificial synthetase	
<400> 33	
cgggggctgg tagcccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc	60
ccgatcgcac tcgtttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt	120
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta	180
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac	240
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc	300
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat	360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc	420
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag	480
ttttcctaca acctgctgca gggttattcg atggcctgta cgaacaaaca gtacggtgtg	540
gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctgacc	600
cgtcgtctgc atcagaatca ggtg	624

```
<210>
       34
<211>
       624
<212>
      DNA
<213>
      artificial
<220>
<223> artificial synthetase
<220>
<221> misc_feature
<222>
      (13)..(13)
<223> n is a, c, g, or t
<400> 34
cgggggctgg tancccaagt gacggacggg gaagcgttag cagagcgact ggcgcaaggc
                                                                       60
                                                                      120
ccgatcgcac tcagttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt
                                                                      180
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac
                                                                      240
                                                                      300
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc
                                                                      360
gatctcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc
                                                                      420
                                                                      480
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag
                                                                      540
ttttcctaca acctgctgca gggttatagt tttgcctgtc tgaacaaaca gtacggtgtg
gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctgacc
                                                                      600
                                                                      624
cgtcgtctgc atcagaatca ggtg
<210>
       35
<211>
       624
<212>
       DNA
<213>
      artificial
<220>
<223> artificial synthetase
<400>
cgggggctgg tagcccaggt gacggacgag gaagcgttag cagagcgact ggcgcaaggc
                                                                       60
                                                                      120
ccgatcgcac tcacgtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt
                                                                      180
gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta
ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac
                                                                      240
                                                                      300
accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc
gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat
                                                                      360
atgaatgtgc tgaccttcct gcgcgatatt ggcaaacact tctccgttaa ccagatgatc
                                                                      420
                                                                      480
aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag
```

tttt	ccta	ica a	accto	ctgo	a gg	gtta	ıtacg	ttt	gcct	gta	ctaa	caaa	ica g	gtaco	gtgtg
gtgc	tgca	aa t	tggt	ggtt	c to	jacca	ıgtgg	ggt	aaca	tca	cttc	tggt	at c	gaco	tgacc
cgtc	gtct	gc a	atcag	gaato	a gg	ıtg									
<211 <212	<210> 36 <211> 424 <212> PRT <213> artificial														
	<220> <223> artificial synthetase														
<400> 36 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val															
Met 1	Ala	Ser	Ser	Asn 5	Leu	Ile	Lys	Gln	Leu 10	Gln	Glu	Arg	Gly	Leu 15	Val
Ala	Gln	Val	Thr 20	Asp	Glu	Glu	Ala	Leu 25	Ala	Glu	Arg	Leu	Ala 30	Gln	Gly
Pro	Ile	Ala 35	Leu	Val	Cys	Gly	Phe 40	Asp	Pro	Thr	Ala	Asp 45	Ser	Leu	His
Leu	Gly 50	His	Leu	Val	Pro	Leu 55	Leu	Cys	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Туг 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Tyr	Ala	Cys 185	Leu	Asn	Lys	Gln	Tyr 190	Gly	Val

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 205
Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210 215 220
Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 235 240
Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe 245 250 255
Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu 260 265 270
Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu 275 280 285
Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300
Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320
Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335
Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350
Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365
Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380
Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400
Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415
Asn Tyr Cys Leu Ile Cys Trp Lys . 420
<210> 37 <211> 424 <212> PRT <213> artificial

<223> artificial synthetase

<400> 37

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
20 25 30

Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Leu Asn Lys Gln Tyr Gly Val 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 235 240

Gly Gly Ala	Val Trp 245	Leu Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr Gln Phe	Trp Ile 260	Asn Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys Phe Phe 275	Thr Phe	Met Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu Asp Lys 290	Asn Ser	Gly Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu Gln Val 305	Thr Arg	Leu Val 310	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys Arg Ile	Thr Glu 325	Cys Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu Ala Asp	Phe Glu 340	Gln Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met Glu Lys 355	Gly Ala	Asp Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln Pro Ser 370	Arg Gly	Gln Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr Ile Asn 385	Gly Glu	Lys Gln 390	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu Asp Arg	Leu Phe 405	Gly Arg	Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn Tyr Cys	Leu Ile 420	Cys Trp	Lys								
<210> 38 <211> 424 <212> PRT <213> arti:	ficial										
<220> <223> arti:	ficial sy	ynthetas	e							*	
<400> 38					ı						
Met Ala Ser 1	Ser Asn 5	Leu Ile	Lys	Gln	Leu 10	Gln	Glu	Arg	Gly	Leu 15	Val
Ala Gln Val	Thr Asp	Glu Glu	Ala	Leu 25	Ala	Glu	Arg	Leu	Ala 30	Gln	Gly

Pro	·Ile	Ala 35	Leu	Val	Cys	Gly	Phe 40	qaA	Pro	Thr	Ala	Asp 45	Ser	Leu	His
Leu	Gly 50	His	Leu	Val	Pro	Leu 55	Leu	Cys	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Met	Ala	Cys 185	Ala	Asn	Lys	Gln	Tyr 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300
Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320
Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335
Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350
Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365
Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380
Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400
Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415
Asn Tyr Cys Leu Ile Cys Trp Lys 420
<210> 39 <211> 424 <212> PRT <213> artificial
<220> <223> artificial synthetase
<400> 39
Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15
Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30
Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45
Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60
Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80
Page 27

Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Суѕ	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Туг 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Met	Ala	Cys 185	Leu	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 360 365 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 410 Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 40 <211> 424 <212> PRT <213> artificial <220> <223> artificial synthetase <400> Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 90 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115

Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Туг 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Thr	Met	Ala	Cys 185	Leu	Asn	Lys	Gln	Tyr 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln	Pro 370	Ser	Arg	Gly	Gln	Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400													
Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415													
Asn Tyr Cys Leu Ile Cys Trp Lys 420													
<210> 41 <211> 424 <212> PRT <213> artificial													
<220> <223> artificial synthetase													
<400> 41													
Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15													
Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30													
Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45													
Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60													
Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80													
Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95													
Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110													
Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125													
Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135 140													
His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160													
Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175													

Leu L	eu	Gln	Gly 180	Tyr	Thr	Tyr	Ala	Cys 185	Leu	Asn	Lys	Gln	Tyr 190	Gly	Val
Val L	∍eu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile A	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val P 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly G	Sly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr G	Sln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys F	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu A	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 6 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys A	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu A	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met (Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln I	Pro 370	Ser	Arg	Gly	Gln	Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr 1	Ile	Asn	Gly	Glu	Lys 390	Gln	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu A	Asp	Arg	Leu	Phe 405	Gly	Arg	Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn 1	Гуr	Cys	Leu 420	Ile	Cys	Trp	Lys								

<210> 42 <211> 424 <212> PRT <213> artificial <220> <223> artificial synthetase <400> 42 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 60 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 135 130 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 170 Leu Leu Gln Gly Tyr Ser Met Ala Cys Ser Asn Lys Gln Tyr Gly Val 185 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210

Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Туr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln	Pro 370	Ser	Arg	Gly	Gln	Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr 385	Ile	Asn	Gly	Glu	Lys 390	Gln	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu	Asp	Arg	Leu	Phe 405	Gly	Arg	Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn	Tyr	Cys	Leu 420	Ile	Cys	Trp	Lys								
<21 <21 <21 <21	1> 2>	43 424 PRT arti	fici	al											
<22 <22		arti	fici	al s	ynth:	etas	e								
<40	0>	43													
Met 1	Ala	Ser	Ser	Asn 5	Leu	Ile	Lys	Gln	10	Gln ge 3		Arg	Gly	Leu 15	Val

Ala	Gln	Val	Thr 20	Asp	Glu	Glu	Ala	Leu 25	Ala	Glu	Arg	Leu	Ala 30	Gln	Gly
Pro	Ile	Ala 35	Leu	Leu	Cys	Gly	Phe 40	Asp	Pro	Thr	Ala	Asp 45	Ser	Leu	His
Leu	Gly 50	His	Leu	Val	Pro	Leu 55	Leu	Cys	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Met	Ala	Cys 185	Ala	Asn	Lys	Gln	Tyr 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
				245					250				Tyr	255	
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 295 300 290 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 330 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 375 370 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 410 405 Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 44 <211> 424 <212> PRT <213> artificial <220> artificial synthetase <223> <400> 44 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 45 35 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55

Page 36

Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Туг 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Arg	Met	Ala	Cys 185	Leu	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 375 380 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 45 <211> 424 <212> PRT <213> artificial <220> <223> artificial synthetase <400> 45 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 5 Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 105 100

Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu		Gly 180	Tyr	Gly	Met	Ala	Cys 185	Ala	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280		Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 390 395 385 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 46 <211> 424 <212> PRTartificial <213> <220> <223> artificial synthetase <400> 46 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 25 Pro Ile Ala Leu Gly Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg

155

Page 40

150

Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Gly	Phe	Ala	Cys 185	Ala	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln	Pro 370	Ser	Arg	Gly	Gln	Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr 385	Ile	Asn	Gly	Glu	Lys 390	Gln	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu	Asp	Arg	Leu	Phe 405	Gly	Arg	Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 47

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 47

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30

Pro Ile Ala Leu Gly Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 ' 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Gly Tyr Ala Cys Met Asn Lys Gln Tyr Gly Val 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 205

Ile Asp Leu 210	Thr Arg	Arg Leu 215	His (Gln /	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val Pro Leu 225	Ile Thr	Lys Ala 230	Asp (Gly '	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly Gly Ala	Val Trp 245	Leu Asp	Pro I		Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr Gln Phe	Trp Ile 260	Asn Thr		Asp . 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys Phe Phe 275	Thr Phe	Met Ser	Ile (280	Glu (Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu Asp Lys 290	Asn Ser	Gly Lys 295	Ala	Pro .	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu Gln Val 305	Thr Arg	Leu Val 310	His (Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys Arg Ile	Thr Glu 325	Cys Leu	Phe :		Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu Ala Asp	Phe Glu 340	Gln Leu		Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met Glu Lys 355	Gly Ala	Asp Leu	Met (Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln Pro Ser 370	Arg Gly	Gln Ala 375	Arg :	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr Ile Asn 385	Gly Glu	Lys Gln 390	Ser .	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu Asp Arg	Leu Phe 405	Gly Arg	Phe '	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn Tyr Cys	Leu Ile 420	Cys Trp	Lys							,	
<210> 48 <211> 424 <212> PRT <213> arti	ficial										
<220> <223> arti	ficial s	ynthetas	е		Pac	TE 4	3				

			Ser					Gln						Leu 15	Val
Ala	Gln	Val	Thr	Asp	Glu	Glu	Ala	Leu	Ala	Glu	Arg	Leu	Ala	Gln	Gly

20 25 30

Pro Ile Ala Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Ala Asn Lys Gln Tyr Gly Val 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu 280 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 295 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 315 310 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 330 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 345 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 375 370 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 49 <211> 424 <212> PRT <213> artificial <220> <223> artificial synthetase

<400> 49

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His Page 45

Leu	Gly 50	His	Leu	Val	Pro	Leu 55	Leu	Cys	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Ala	Ala	Cys 185	Ala	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 310 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 390 395 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 410 405 Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 50 <211> 424 <212> PRT <213> artificial <220> <223> artificial synthetase <400> 50 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 40 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 55 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 75 65 70

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr

85	90	95

Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155		Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Туг 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Ala	Ala	Cys 185	Ala	Asn	Lys	Gln	Tyr 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340		Gln	Leu	Ala	Gln 345		Gly	Val	Pro	Met 350	Val	Glu

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 51

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 51

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His $35 \hspace{1cm} 40 \hspace{1cm} 45$

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys Page 49 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 150 155 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 Leu Leu Gln Gly Tyr Ser Ala Ala Cys Val Asn Lys Gln Tyr Gly Val 180 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 215 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 310 315 305 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 390 395 Page 50

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 52

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 52

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30

Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asp Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Asn Phe Ala Cys Val Asn Lys Gln Tyr Gly Val Page 51 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300.

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile $370 \hspace{1cm} 375 \hspace{1cm} 380$

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 53 <211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 53

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His $35 \hspace{1cm} 40 \hspace{1cm} 45$

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Leu Asn Lys Gln Tyr Gly Val 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu Page 53 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 54

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 54

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala	Gln	Val	Thr 20	Asp	Glu	Glu	Ala	Leu 25	Ala	Glu	Arg	Leu	Ala 30	Gln	Gly
Pro	Ile	Ala 35	Leu	Gly	Cys	Gly	Phe 40	Asp	Pro	Thr	Ala	Asp 45	Ser	Leu	His
Leu	Gly 50	His	Leu	Val	Pro	Leu 55	Leu	Cys	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Met	Ala	Cys 185	Leu	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe	Thr	Phe	Met	Ser	Ile	Glu	Glu	Ile	Asn	Ala	Leu	Glu	Glu

275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile $370 \hspace{1cm} 375 \hspace{1cm} 380$

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 55

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 55

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gl
n Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gl
n Gly 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His $35 \hspace{1cm} 40 \hspace{1cm} 45$

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Суѕ	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Ala	Ala	Cys 185	Leu	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu	Cys	Leu	Phe	Ser	Gly	Ser	Leu	Ser	Ala	Leu	Ser

325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 56

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 56

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30

Pro Ile Ala Leu Ser Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Thr	Met	Ala	Cys 185	Val	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln	Pro	Ser	Arg	Gly	Gln	Ala	Arg	Lys		Ile ge 5		Ser	Asn	Ala	Ile

370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 57

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 57

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
20 25 30

Pro Ile Ala Leu Ala Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Tyr	Ala	Cys 185	Leu	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly 、
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln	Pro 370	Ser	Arg	Gly	Gln	Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr 385	Ile	Asn	Gly	Glu	Lys 390	Gln	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu	Asp	Arg	Leu	Phe 405	Gly	Arg	Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn	Tyr	Cys	Leu	Ile	Cys	Trp	Lys								

<210> 58

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 58

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly 20 25 30

Pro Ile Ala Leu Ala Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Thr Met Ala Cys Cys Asn Lys Gln Tyr Gly Val 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly 195 200 205

Ile Asp Leu Thr 2	Arg Arg Leu His 215	Gln Asn Gln Val 220	Phe Gly Leu Thr
Val Pro Leu Ile ' 225	Thr Lys Ala Asp 230	Gly Thr Lys Phe 235	Gly Lys Thr Glu 240
Gly Gly Ala Val	Trp Leu Asp Pro 245	Lys Lys Thr Ser 250	Pro Tyr Lys Phe 255
Tyr Gln Phe Trp : 260	Ile Asn Thr Ala	Asp Ala Asp Val 265	Tyr Arg Phe Leu 270
Lys Phe Phe Thr : 275	Phe Met Ser Ile 280	Glu Glu Ile Asn	Ala Leu Glu Glu 285
Glu Asp Lys Asn : 290	Ser Gly Lys Ala 295	Pro Arg Ala Gln 300	Tyr Val Leu Ala
Glu Gln Val Thr 3	Arg Leu Val His 310	Gly Glu Glu Gly 315	Leu Gln Ala Ala 320
Lys Arg Ile Thr	Glu Cys Leu Phe 325	Ser Gly Ser Leu 330	Ser Ala Leu Ser 335
Glu Ala Asp Phe 340	Glu Gln Leu Ala	Gln Asp Gly Val 345	Pro Met Val Glu 350
Met Glu Lys Gly . 355	Ala Asp Leu Met 360		Asp Ser Glu Leu 365
Gln Pro Ser Arg	Gly Gln Ala Arg 375	Lys Thr Ile Ala 380	Ser Asn Ala Ile
Thr Ile Asn Gly	Glu Lys Gln Ser 390	Asp Pro Glu Tyr 395	Phe Phe Lys Glu 400
	Phe Gly Arg Phe 405	Thr Leu Leu Arg 410	Arg Gly Lys Lys 415
Asn Tyr Cys Leu 420	Ile Cys Trp Lys		
<210> 59 <211> 424 <212> PRT <213> artificia	1		
<220> <223> artificia	l synthetase		
<400> 59		Page 63	

Met 1	Ala	Ser	Ser	Asn 5	Leu	Ile	Lys	Gln	Leu 10	Gln	Glu	Arg	Gly	Leu 15	Val
Ala	Gln	Val	Thr 20	Asp	Glu	Glu	Ala	Leu 25	Ala	Glu	Arg	Leu	Ala 30	Gln	Gly
Pro	Ile	Ala 35	Leu	Thr	Cys	Gly	Phe 40	Asp	Pro	Thr	Ala	Asp 45	Ser	Leu	His
Leu	Gly 50	His	Leu	Val	Pro	Leu 55	Leu	Суѕ	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Thr	Phe	Ala	Cys 185	Met	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe

		275					280					285			
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln	Pro 370	Ser	Arg	Gly	Gln	Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr 385	Ile	Asn	Gly	Glu	Lys 390	Gln	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu	Asp	Arg	Leu	Phe 405	Gly	Arg	Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn	Tyr	Cys	Leu 420	Ile	Cys	Trp	Lys								
<210 <211 <212 <213	L> 4 2> 1	60 124 PRT artii	Eicia	al									٠		
<220 <223		arti	Eicia	al sy	nthe	etase	e								
<400)> (60													
Met 1	Ala	Ser	Ser	Asn 5	Leu	Ile	Lys	Gln	Leu 10	Gln	Glu	Arg	Gly	Leu 15	Val
Ala	Gln	Val	Thr 20	Asp	Glu	Glu	Ala	Leu 25	Ala	Glu	Arg	Leu	Ala 30	Gln	Gly
Pro	Ile	Ala 35	Leu	Thr	Cys	Gly	Phe 40	Asp	Pro	Thr	Ala	Asp 45	Ser	Leu	His
									Pa	ge 6	5				

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu

Leu	Gly 50	His	Leu	Val	Pro	Leu 55	Leu	Cys	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly 65	His	Lys	Pro	Val	Ala 70	Leu	Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp	Pro	Ser	Phe	Lys 85	Ala	Ala	Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr
Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Tyr 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Val	Ala	Cys 185	Leu	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala

Glu Gln Val 305	Thr Arg	Leu Va	l His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys Arg Ile	Thr Glu 325	Cys Le	ı Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu Ala Asp	Phe Glu 340	Gln Le	u Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met Glu Lys 355	Gly Ala	Asp Le	u Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln Pro Ser 370	Arg Gly	Gln Al		Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr Ile Asn 385	Gly Glu	Lys Gl	n Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu Asp Arg	Leu Phe 405	Gly Ar	g Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn Tyr Cys	Leu Ile 420	Cys Tr	p Lys								ž.
<210> 61 <211> 424 <212> PRT <213> artis	ficial										
<220> <223> artii	ficial s	yntheta	se								
<400> 61											·
Met Ala Ser 1	Ser Asn 5	Leu Il	e Lys	Gln	Leu 10	Gln	Glu	Arg	Gly	Leu 15	Val
Ala Gln Val	Thr Asp 20	Glu Gl	u Ala	Leu 25	Ala	Glu	Arg	Leu	Ala 30	Gln	Gly
Pro Ile Ala 35	Leu Val	Cys Gl	y Phe 40	Asp	Pro	Thr	Ala	Asp 45	Ser	Leu	His
Leu Gly His 50	Leu Val	Pro Le 55	u Leu	Cys	Leu	Lys	Arg 60	Phe	Gln	Gln	Ala
Gly His Lys 65	Pro Val	Ala Le 70	u Val	Gly	Gly	Ala 75	Thr	Gly	Leu	Ile	Gly 80
Asp Pro Ser	Phe Lys 85	Ala Al	a Glu	Arg	Lys 90	Leu	Asn	Thr	Glu	Glu 95	Thr

Val	Gln	Glu	Trp 100	Val	Asp	Lys	Ile	Arg 105	Lys	Gln	Val	Ala	Pro 110	Phe	Leu
Asp	Phe	Asp 115	Cys	Gly	Glu	Asn	Ser 120	Ala	Ile	Ala	Ala	Asn 125	Asn	Tyr	Asp
Trp	Phe 130	Gly	Asn	Met	Asn	Val 135	Leu	Thr	Phe	Leu	Arg 140	Asp	Ile	Gly	Lys
His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Туг 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Met	Ala	Cys 185	Thr	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Glý	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 360 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 375 380 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 62 <211> 424 <212> PRT <213> artificial <220> <223> artificial synthetase <400> 62 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly Pro Ile Ala Leu Ser Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 105 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 135

His 145	Phe	Ser	Val	Asn	Gln 150	Met	Ile	Asn	Lys	Glu 155	Ala	Val	Lys	Gln	Arg 160
Leu	Asn	Arg	Glu	Asp 165	Gln	Gly	Ile	Ser	Phe 170	Thr	Glu	Phe	Ser	Туг 175	Asn
Leu	Leu	Gln	Gly 180	Tyr	Ser	Phe	Ala	Cys 185	Leu	Asn	Lys	Gln	Туг 190	Gly	Val
Val	Leu	Gln 195	Ile	Gly	Gly	Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile	Asp 210	Leu	Thr	Arg	Arg	Leu 215	His	Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val 225	Pro	Leu	Ile	Thr	Lys 230	Ala	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly	Gly	Ala	Val	Trp 245	Leu	Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr	Gln	Phe	Trp 260	Ile	Asn	Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys	Phe	Phe 275	Thr	Phe	Met	Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu	Asp 290	Lys	Asn	Ser	Gly	Lys 295	Ala	Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu 305	Gln	Val	Thr	Arg	Leu 310	Val	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys	Arg	Ile	Thr	Glu 325	Cys	Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu	Ala	Asp	Phe 340	Glu	Gln	Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met	Glu	Lys 355	Gly	Ala	Asp	Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln	Pro 370	Ser	Arg	Gly	Gln	Ala 375	Arg	Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr 385	Ile	Asn	Gly	Glu	Lys 390	Gln	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 410 Asn Tyr Cys Leu Ile Cys Trp Lys 420 <210> 63 <211> 424 <212> PRT <213> artificial <220> <223> artificial synthetase <400> 63 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 105 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 135 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 175 165 170

Leu Leu Gln Gly Tyr Thr Phe Ala Cys Thr Asn Lys Gln Tyr Gly Val

185

180

Val Leu Gln 195	Ile Gly	Gly Ser	Asp 200	Gln	Trp	Gly	Asn	Ile 205	Thr	Ser	Gly
Ile Asp Leu 210	Thr Arg	Arg Leu 215		Gln	Asn	Gln	Val 220	Phe	Gly	Leu	Thr
Val Pro Leu 225	Ile Thr	Lys Ala 230	Asp	Gly	Thr	Lys 235	Phe	Gly	Lys	Thr	Glu 240
Gly Gly Ala	Val Trp 245	Leu Asp	Pro	Lys	Lys 250	Thr	Ser	Pro	Tyr	Lys 255	Phe
Tyr Gln Phe	Trp Ile 260	Asn Thr	Ala	Asp 265	Ala	Asp	Val	Tyr	Arg 270	Phe	Leu
Lys Phe Phe 275	Thr Phe	Met Ser	Ile 280	Glu	Glu	Ile	Asn	Ala 285	Leu	Glu	Glu
Glu Asp Lys 290	Asn Ser	Gly Lys 295		Pro	Arg	Ala	Gln 300	Tyr	Val	Leu	Ala
Glu Gln Val 305	Thr Arg	Leu Val 310	His	Gly	Glu	Glu 315	Gly	Leu	Gln	Ala	Ala 320
Lys Arg Ile	Thr Glu 325	Cys Leu	Phe	Ser	Gly 330	Ser	Leu	Ser	Ala	Leu 335	Ser
Glu Ala Asp	Phe Glu 340	Gln Leu	Ala	Gln 345	Asp	Gly	Val	Pro	Met 350	Val	Glu
Met Glu Lys 355	Gly Ala	Asp Leu	Met 360	Gln	Ala	Leu	Val	Asp 365	Ser	Glu	Leu
Gln Pro Ser 370	Arg Gly	Gln Ala 375		Lys	Thr	Ile	Ala 380	Ser	Asn	Ala	Ile
Thr Ile Asn 385	Gly Glu	Lys Glr 390	Ser	Asp	Pro	Glu 395	Tyr	Phe	Phe	Lys	Glu 400
Glu Asp Arg	Leu Phe 405	Gly Arg	Phe	Thr	Leu 410	Leu	Arg	Arg	Gly	Lys 415	Lys
Asn Tyr Cys	Leu Ile 420	Cys Trp	Lys								
<210> 64 <211> 129 <212> DNA <213> Esche	erichia	coli									
					Pa	ae 7	2				

	64 :cga taagggagca	ggccagtaaa	aagcattacc	ccgtggtggg	gttcccgagc	60
ggccaaa	iggg agcagactct	aaatctgccg	tcatcgacct	cgaaggttcg	aatccttccc	120
ccaccac	ca				• .	129
<210><211><211><212><213>	65 129 RNA Escherichia co	oli				
<400>	65					
agcuuco	cga uaagggagca	ggccaguaaa	aagcauuacc	ccgugguggg	guucccgagc	60
ggccaaa	nggg agcagacucu	aaaucugccg	ucaucgaccu	cgaagguucg	aauccuuccc	120
ccaccac	ca					129
<210><211><211><212><213>	66 34 DNA artificial					
<220> <223>	oligonucleotic	de primer				
<400> atgaagt	66 agc tgtcttctat	: cgaacaagca	tgcg			34
<210><211><211><212><213>	67 34 DNA artificial		·			
<220> <223>	oligonucleotic	de primer				
<400> cgaacaa	67 agca tgcgattagt	gccgacttaa	aaag			34
<210><211><211><212><213>	68 33 DNA artificial					
<220> <223>	oligonucleotic	de primer				
<400> cgctact	68 cctc ccaaatagaa	a aaggteteeg	ctg			33
<210><211><211><212><213>	69 32 DNA artificial					
<220>	oligonucleotic	le primer				

<400> ctggaa	69 cagc tatagctact gatttttcct cg	32
<210><211><211><212><213>	70 34 DNA artificial	
<220> <223>	oligonucleotide primer	
<400> gccgtc	70 acag attagttggc ttcagtggag actg	34
<210><211><212><213>	71 33 DNA artificial	
<220> <223>	oligonucleotide primer	
<400> gattgg	71 cttc ataggagact gatatgctct aac	33
<210><211><211><212><213>	72 33 DNA artificial	
<220> <223>	oligonucleotide primer	
<400> gcctct	72 atag ttgagacagc atagaataat gcg	33
<210><211><211><212><213>	73 35 DNA artificial	
<220> <223>	oligonucleotide primer	
<400> gagaca	73 gcat agatagagtg cgacatcatc atcgg	35
<210><211><211><212><213>	DNA	
<220> <223>	oligonucleotide primer	
<400> gaataa	74 gtgc gacatagtca tcggaagaga gtagtag	37

```
<210> 75
<211>
      35
<212>
      DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 75
                                                                     35
ggtcaaagac agttgtaggt atcgattgac tcggc
<210>
      76
<211>
       34
<212>
      DNA
<213>
      artificial
<220>
<223> oligonucleotide primer
<400> 76
                                                                     34
cgctactctc cccaaattta aaaggtctcc gctg
<210> 77
<211> 34
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 77
                                                                     34
cgctactctc cccaaatata aaaggtctcc gctg
<210> 78
<211> 34
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 78
                                                                      34
cgctactctc cccaaatgga aaaggtctcc gctg
<210>
      79
      34
<211>
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 79
                                                                      34
cgctactctc cccaaagata aaaggtctcc gctg
<210> 80
<211>
<212> DNA
<213> artificial
```

<pre><400> 80 cgctactctc cccaaaaaaa aaaggtctcc gctg 210> 81 2211> 34 2212> DNA 2213> artificial <220> 223> oligonucleotide primer <400> 81 gccgtcacag attttttggc ttcagtggag actg 211> 34 2212> DNA 2213> artificial <220> 2211> 34 2212> DNA 2213> artificial <220> 223> oligonucleotide primer <400> 82 gccgtcacag attatttggc ttcagtggag actg 34 <210> 82 221> 34 2212> DNA 2213> artificial <220> 223> oligonucleotide primer <400> 82 gccgtcacag attatttggc ttcagtggag actg 34 <210> 83 221> 34 2212> DNA 2213> artificial <220> 223> oligonucleotide primer <400> 83 gccgtcacag attggttggc ttcagtggag actg 34 <210> 84 221> 34 221> DNA 2213> artificial <220> 223> oligonucleotide primer <400> 84 c211> 34 c212> DNA 2213> artificial <220> c223> oligonucleotide primer <400> 84 c211> 34 c212> DNA c213> artificial <220> c223> oligonucleotide primer <400> 84 c210> 84 c211> 34 c212> DNA c213> artificial <220> c223> oligonucleotide primer <400> 84 c210> 84 c211> 34 c212> DNA c213> artificial <220> c223> oligonucleotide primer <400> 84 c210> 84 c210> 84 c210> 84 c211> 34 c212> DNA c213> artificial <220> c223> oligonucleotide primer <400> 84 c210> 84 c</pre>
<pre><211> 34 <212> DNA <213> artificial </pre> <pre><220> <223> oligonucleotide primer </pre> <pre><400> 81 gccgtcacag attttttggc ttcagtggag actg <pre><210> 82 <211> 34 <212> DNA <213> artificial </pre> <pre><220> <223> oligonucleotide primer </pre> <pre><400 82 gccgtcacag attatttggc ttcagtggag actg <pre><220> <223> oligonucleotide primer </pre> <pre><400 82 gccgtcacag attatttggc ttcagtggag actg <pre><210> 83 <211> 34 <212> DNA <213> artificial </pre> <pre><213> oligonucleotide primer </pre> <pre><400 83 gccgtcacag attattficial </pre> <pre><220> <223> oligonucleotide primer </pre> <pre><400 83 gccgtcacag attggttggc ttcagtggag actg <pre><220> <223> oligonucleotide primer </pre> <pre><400 84 </pre> <pre><210> 84 </pre> <pre><211> 34 <212> DNA <213> artificial </pre> <pre><220> <223> oligonucleotide primer </pre> <pre><400> 84</pre></pre></pre></pre></pre>
<pre><223> oligonucleotide primer <400> 81 gccgtcacag attttttggc ttcagtggag actg</pre>
34
<pre><211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 82 gccgtcacag attatttggc ttcagtggag actg <210> 83 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 83 gccgtcacag attatttggc ttcagtggag actg <210> 83 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 83 gccgtcacag attggttggc ttcagtggag actg 34 <210> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84</pre>
<pre><223> oligonucleotide primer <400> 82 gccgtcacag attatttggc ttcagtggag actg 34 <210> 83 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 83 gccgtcacag attggttggc ttcagtggag actg 34 <210> 84 <211> 34 <211> 34 <212> DNA <213 artificial <220> <223> oligonucleotide primer <400> 83 gccgtcacag attggttggc ttcagtggag actg 34 <210> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84</pre>
<pre>gccgtcacag attatttggc ttcagtggag actg <210> 83 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 83 gccgtcacag attggttggc ttcagtggag actg 34 <210> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84</pre> <pre> <10> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84</pre>
<pre><211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 83 gccgtcacag attggttggc ttcagtggag actg 34 <210> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer</pre>
<223> oligonucleotide primer <400> 83 gccgtcacag attggttggc ttcagtggag actg <210> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84
gccgtcacag attggttggc ttcagtggag actg <210> 84 <211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84
<211> 34 <212> DNA <213> artificial <220> <223> oligonucleotide primer <400> 84
<223> oligonucleotide primer <400> 84
geegteacag atgatttgge tteagtggag actg 34
<210> 85 <211> 34 <212> DNA <213> artificial
<220> <223> oligonucleotide primer
<400> 85 gccgtcacag ataaattggc ttcagtggag actg Page 76

<210> 86

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 86

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
20 25 30

Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys 130 · 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg 145 150 155 160

Leu Asn Arg Glu Gly Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn 165 170 175

Leu Leu Gln Gly Tyr Gly Met Ala Cys Ala Asn Lys Gln Tyr Gly Val 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
Page 77

210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys 420

<210> 87

<211> 6

<212> PRT

<213> artificial

<220>

<223> tryptic peptide including unnatural amino acids

<220>

```
<221> MISC_FEATURE
<222>
      (2)..(2)
<223> X is an unnatural amino acid (p-acetyl-L-phenylalanine,
       p-benzoyl-L-phenylalanine, p-azido-L-phenylalanine,
       O-methyl-L-tyrosine, or p-iodo-L-phenylalanine) or trypotophan,
       tyrosine, or leucine
<400> 87
Val Xaa Gly Ser Ile Lys
                5
<210>
       88
<211>
       11
<212> DNA
<213> artificial
<220>
<223> B box
<220>
<221>
     misc_feature
<222>
      (8)..(8)
<223> n is a, c, g, or t
<400> 88
                                                                       11
ggttcgantc c
<210>
       89
<211>
       82
<212>
       DNA
<213>
      artificial
<220>
<223>
       oligonucleotide primer
<400> 89
ggggggaccg gtggggggac cggtaagctt cccgataagg gagcaggcca gtaaaaagca
                                                                       60
                                                                       82
ttaccccgtg gtgggttccc ga
<210> 90
<211> 90
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 90
ggcggcgcta gcaagcttcc cgataaggga gcaggccagt aaaaagggaa gttcagggac
                                                                       60
                                                                       90
ttttgaaaaa aatggtggtg ggggaaggat
<210>
       91
<211>
      68
<212> DNA
<213> artificial
<220>
```

```
<223> oligonucleotide primer
<220>
<221> misc_feature
<222>
      (1)..(1)
<223> n=I
<220>
<221> misc_feature
<222>
      (14)..(14)
<223> n=I
<400> 91
nggggggacc ggtngggggg accggtcggg atcgaagaaa tgatggtaaa tgaaatagga
                                                                      60
                                                                      68
aatcaagg
<210> 92
<211> 62
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
                                                                      60
gggggggaat tcagttgatt gtatgcttgg tatagcttga aatattgtgc agaaaaagaa
                                                                      62
ac
<210> 93
<211> 86
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
                                                                      60
tcataacgag aattccggga tcgaagaaat gatggtaaat gaaataggaa atctcataac
gagaattcat ggcaagcagt aacttg
                                                                      86
<210> 94
<211>
      72
<212>
      DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 94
ttactacgtg cggccgcatg gcaagcagta acttgttact acgtgcggcc gcttatttcc
                                                                      60
                                                                      72
agcaaatcag ac
<210> 95
<211> 28
<212> DNA
<213> artificial
```

```
<220>
     oligonucleotide primer
<223>
<400> 95
                                                                      28
ccgatcgcgc tcgcttgcgg cttcgatc
<210> 96
<211> 27
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 96
                                                                      27
atcgcggcga acgcctatga ctggttc
<210> 97
<211> 40
<212>
      DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 97
gttgcagggt tatgccgccg cctgtgcgaa caaacagtac
                                                                      40
<210>
       98
<211>
      26
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 98
                                                                      26
gccgctttgc tatcaagtat aaatag
<210> 99
<211> 21
<212> DNA
<213> artificial
<220>
<223> oligonucleotide primer
<400> 99
                                                                      21
caagccgaca accttgattg g
<210> 100
<211>
      60
<212>
      DNA
<213>
      artificial
<220>
<223> oligonucleotide primer
<400> 100
```

ggggaca	agt tigtacaaaa aagcaggeta egecaattit aatcaaagtg ggaatattge	80
<210><211><211><212><213>	101 60 DNA artificial	
<220> <223>	oligonucleotide primer	
<400> ggggaca	101 aagt ttgtacaaaa aagcaggcta ggccaatttt aatcaaagtg ggaatattgc	60
<210><211><211><212><213>	102 58 DNA artificial	
<220> <223>	oligonucleotide primer	
<400> ggggaco	102 cact ttgtacaaga aagctgggtt actctttttt tgggtttggt ggggtatc	58
<210><211><211><212><213>	103 22 DNA artificial	
<220> <223>	oligonucleotide primer	
<400> aagcta	103 tacc aagcatacaa tc	22
<210><211><212><212><213>	104 49 DNA artificial	
<220> <223>	oligonucleotide primer	
<400>	104	49